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(54) Tyre tread

(57) A radial pneumatic tyre has a tread which comprises ribs 12, 13 which are disposed in a herringbone-like manner, and corresponding angular grooves 14 which begin in the centre of the tyre and terminate with an open end in the shoulder of the tyre via an angular portion 20. The ribs 12, 13 are continuously interconnected via webs 18, 19. The angle between the inner parts of the grooves and ribs and the circumferential centre line X-X is from 15° to 30° and the angle ß between the outer groove parts 22 and 23 and the inner groove parts is from 95° to 135°. The ribs may be equal or unequal widths and in the latter case are preferably disposed alternately.

FIG.2

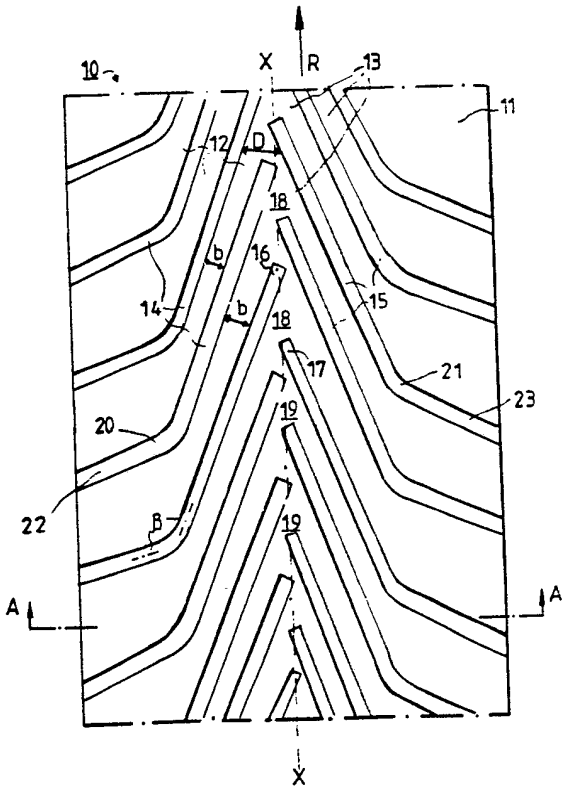

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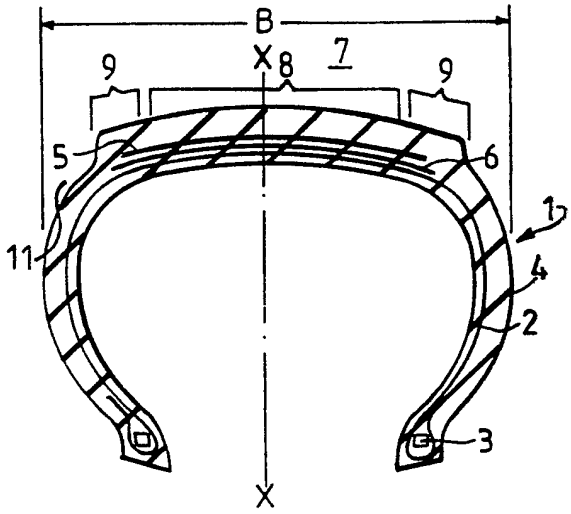
FIG.1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X
8
7
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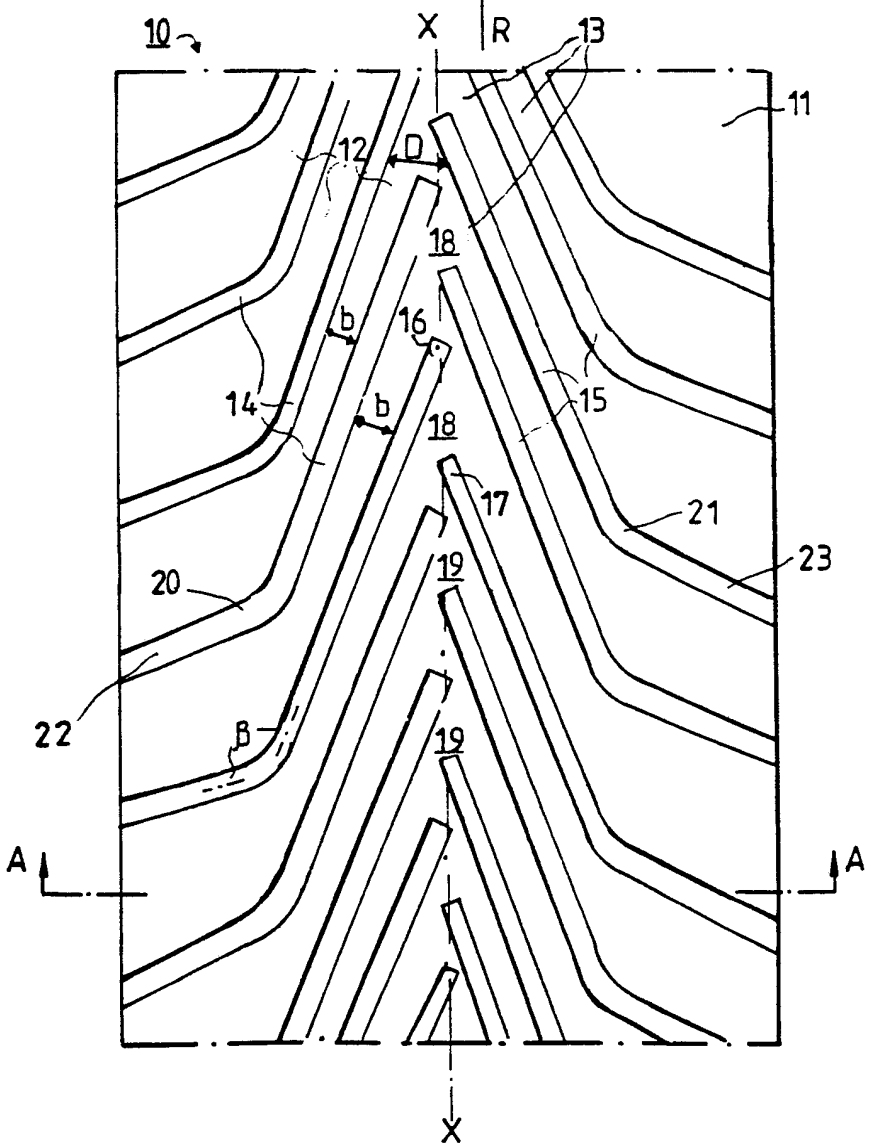
X

FIG.2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X
R
13
11
12
D
18
b
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14
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20
22
B
19
A
A
X

FIG.3

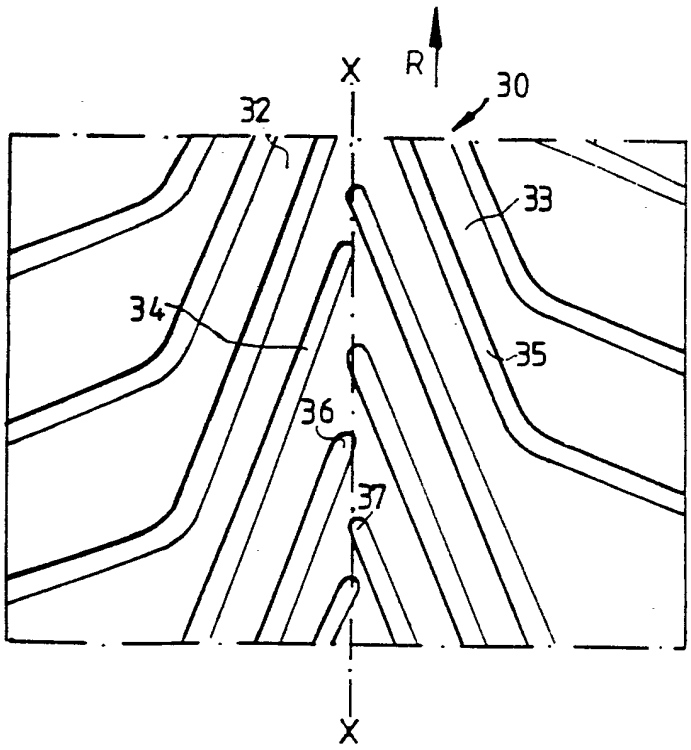


FIG.4

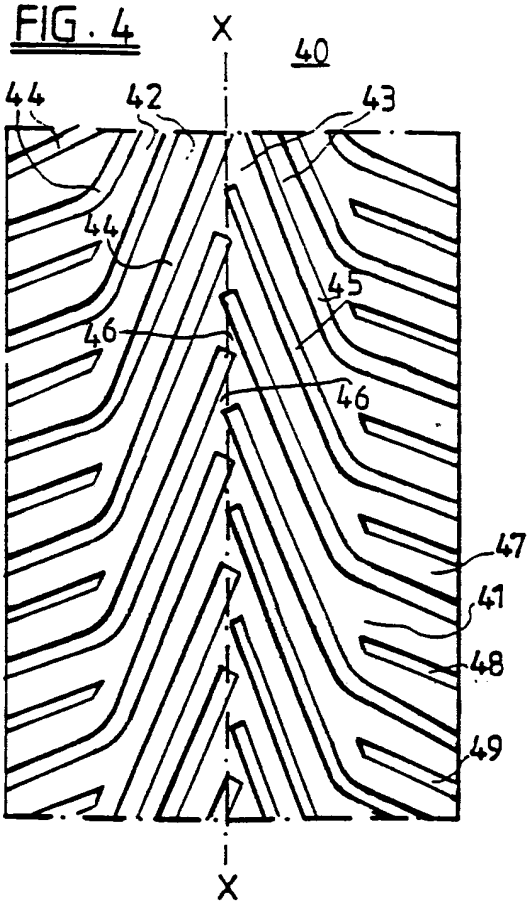
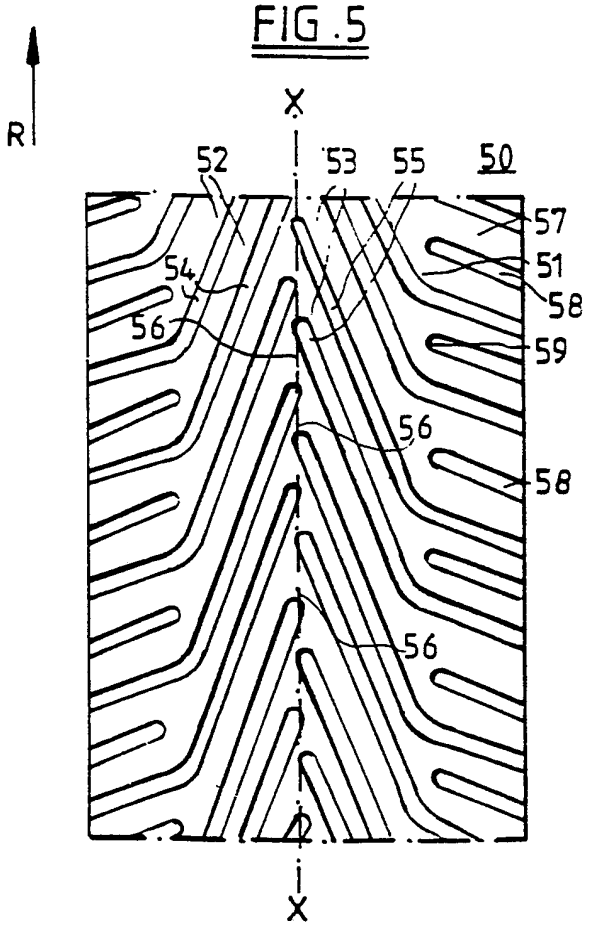


FIG.5



A PNEUMATIC VEHICLE TYRE.

The present invention relates to a pneumatic vehicle tyre which has a radial carcase construction and a tread surface profile which is adapted to the direction of rotation. The tread surface profile has a plurality of rib profile elements, which are orientated at an acute angle relative to the centre line of the tyre circumference and are disposed in such a manner that they extend towards one another when viewed from the tread surface halves. These rib profile elements define profile grooves, which are orientated at an acute angle relative to the centre line of the tyre circumference, have an angular portion in the shoulder of the tyre and terminate in the shoulder.

Pneumatic vehicle tyres are known, which have an angular construction and profile grooves orientated at an acute angle relative to the centre line of the tyre circumference in each half of the tread surface, wherein the shoulder regions are not profiled. Relatively low standards are set for these angular tyres because low speeds and loads are involved, and the tread surface profiling which is provided cannot ensure effective drainage.

Pneumatic vehicle tyres of a radial construction for high-speed vehicles are known from German Offenlegungsschrift No. 3 707 953. The known tread surface profile is formed from one or two relatively wide circumferential grooves, which are situated in the central region of the tread surface, and from a plurality of profile grooves, which are orientated at an acute angle relative to the circumferential line of the tyre and extend towards one another, each groove being bent or having an angular portion at one location. The profile grooves are disposed in a herringbone-like manner, without there being any connection with the circumferential grooves.

This arrangement constitutes a compromise solution in respect of the profiling, which presents the advantages of effective drainage and minimal noise development. However, such a tyre profiling can be improved further.

An object of the invention is to improve further the pneumatic vehicle tyre of the initially described type in respect of drainage and noise development and, in addition thereto, to provide improved values for the following tyre properties: non-skid facility; the absorption of lateral forces; insensitivity when travelling over rails; and rolling resistance.

The technical object of the invention resides in disposing the inclinedly orientated rib profile elements and the inclinedly orientated profile grooves, defined thereby, in such a manner that a herringbone-like profiling is produced which is based upon the centre of the tread surface and is continuous from the centre of the tread surface to the open shoulders of the tyre. For tyres of normal or excessive width, this arrangement serves to ensure effective drainage, minimal noise, a good non-skid facility and a high level of insensitivity when travelling over rails. In addition, the non-skid facility, the rolling resistance and the adaptability to wet conditions are improved. The drainage is to be ensured by the provision of continuous grooves, which terminate in open shoulder regions, without the disadvantages of the above-mentioned tyre properties.

According to the invention, this object is achieved when the profile groove, which is inclinedly orientated at an acute angle, has its beginning or originates in the region of the centre line x-x of the tyre circumference, more especially in the immediate region thereof, that is to say actually on the centre line, the angle of inclined

orientation α being 15° to 30° relative to the centre line x-x of the tyre circumference, and when the rib profile element of one half of the tread surface, which is inclinedly orientated at an acute angle, is connected to the rib profile element of the other half of the tread surface, which is inclinedly orientated at an acute angle, by means of a respective profile element bridging member. The origins or beginnings of the profile grooves, which extend towards one another, are disposed in the region of the centre line, more especially on the centre line x-x of the tyre circumference, so as to be offset from one another in the circumferential direction. In addition, the rib profile elements and the profile grooves in each half of the tread surface are disposed substantially parallel to, and below, one another.

A tread surface profile is thereby produced, which is adapted to the direction of rotation and comprises a system of herringbone-like ribs with a continuous central link, the central web being formed from profile elements/bridging members, and the profile is provided with a system of open, inclined grooves, which system extends in an open manner to the shoulder of the tyre from the centre of the tread surface, via the angular portion which is provided in the groove, because the inclined grooves are relatively long. This tread surface profile ensures a high degree of drainage. Even at high travelling speeds, relatively large volumes of water are advantageously absorbed and conducted away into the shoulder of the tyre in an unhindered manner over the shortest continuous paths.

Furthermore, because the rib profile elements are connected in a herringbone-like manner, this tread surface profile ensures a very low development of noise. The positive-to-negative ratio can be balanced-out.

The distribution of rib and groove is such that they can be provided in a uniform, alternate manner from the centre of the profile to the shoulder of the tyre. The following tyre properties are achieved for the pneumatic vehicle tyre: an improved rolling resistance; a high degree of insensitivity when travelling over rails; a good non-skid facility; and a high level of adaptability to wet conditions. Because of the disposition and provision of the herringbone-like rib profile elements and the inclined grooves defined thereby, a profile is achieved which has a relatively high absorption of lateral forces and non-deformability of shape, which is required, for example, when travelling rapidly round bends. The general driving and steering behaviour is very precise.

According to an additional feature, the inclinedly orientated profile groove has a bend or an angular portion in the shoulder region, which angular portion is situated in the boundary region between the central profile and shoulder profile. In such a case, the profile groove portion is bent at an angle and terminates in the shoulder of the tyre in the vicinity of the radial. The drainage facility is further improved hereby, and the resistance to sliding on water - the feared aquaplaning - is further improved.

According to an additional feature of the invention, the tread surface shoulder regions between the inclined groove portions are advantageously divided-up by means of

additional profile grooves, which terminate with a blind end. These additional profile grooves extend substantially parallel to the groove portions in the shoulder of the tyre, they begin or originate in a blind manner in the region of the reference line on which the angular portions of the main profile grooves are situated, and they terminate with an open end in the shoulder of the tyre.

The present invention will be further illustrated, by way of example, with reference to the accompanying drawings, in which :

Fig. 1 is a cross-sectional view of the tyre taken along the line A - A of Fig. 2;

Fig. 2 is a plan view of a tread surface profile, which is adapted to the direction of rotation and has a herringbone-like configuration;

Fig. 3 is a plan view of a similar tread surface profile, which is adapted to the direction of rotation;

Fig. 4 is a plan view of a modified tread surface profile; and

Fig. 5 is a plan view of an additional, modified tread surface profile, which is adapted to the direction of rotation and has a herringbone-like configuration.

The pneumatic vehicle tyre 1 of Fig. 1 has a radial carcase construction, wherein the radial carcase is referenced 2, the tyre beads are referenced 3, the lateral walls are referenced 4, a belt-like reinforcement is referenced 5, and the tread strip is referenced 6.

The tread surface profile 7 is adapted to the direction of rotation, and it includes a central region 8 and two shoulder regions 9. The centre line of the tyre circumference is

referenced x-x. The direction of rotation of the pneumatic vehicle tyre is referenced R.

The tread surface profile 10 of Fig. 2 is illustrated in such a manner that the transitional regions 11 of the shoulder are seen to extend towards the lateral walls and turn upwardly into the plane of the tread surface.

The tread surface profile comprises inclinedly orientated rib profile elements 12 and 13, the rib 12 of one half of the tread surface extending in the opposite direction to the rib 13 of the other half of the tread surface. The rib profile elements define inclinedly orientated grooves 14 of one half of the tread surface and corresponding profile grooves 15 of the other half of the tread surface. The grooves and ribs extend substantially parallel to one another. The angle α, which they subtend with the centre line x-x of the circumference, is in the range of 15° to 30°. This arrangement produces a steeply orientated herringbone-like profile.

In such a case, the essential factor is that the beginnings 16 and 17 respectively of the inclined profile grooves are situated in the region of the centre line x-x. This is advantageously the immediate region of the centre line, the beginnings being situated on this centre line. In this region, the rib profile elements 12 and 13 are continuously interconnected by means of profile element bridging members or webs 18 and 19 respectively. The herringbone-like configuration is hereby preferably based on the centre line x-x. Thus, there are relatively long, straight diagonal grooves and a rib web which is continuously connected in the central region of the profile.

The profile grooves 14 and 15, in this case, extend over the entire central region 8 and over a predetermined shoulder region 9. A respective angular portion 20 or 21 of each groove is disposed at the boundary between these

regions. The profile groove portions 22 and 23 extend from here at an angle β of approximately 95° to 135° relative to the centre of the profile groove 14 and 15 respectively.

Thus, the transition into the shoulder region 11 occurs advantageously in the direction of the radial, and the drainage paths remain open, in a continuous manner, as far as the open shoulder of the tyre from the centre of the tread surface. The tread surface profile of Fig. 2 has straight groove beginnings. Fig. 3 shows that the tread surface profile 30 is rounded in the groove beginnings 36 and 37 of the inclined profile grooves 34 and 35.

In such a case, the profile grooves are defined by substantially identical, parallel and long, straight, inclinedly orientated rib profile elements 32 and 33, which are continuously interconnected in the central region by means of profile webs.

Figs. 4 and 5 show similar tread surface profiles 40 and 50 respectively, which have a tread surface profile adapted to the direction of rotation. The inclinedly orientated rib profile elements are referenced 42 and 43 or 52 and 53 here. The profile grooves are referenced 44 and 45 or 54 and 55.

The groove beginnings are substantially situated on the reference centre line x-x. Here also, the profile element bridging members or webs 46 and 56 respectively, which are provided, provide a continuous link between the inclined ribs in the centre of the tread surface. The shoulder regions 41 and 47 or 51 and 57 respectively are additionally provided here with

shoulder profile grooves 48 and 58, which begin blind. They begin in the region of the line on which is situated the angular portion of the main profile grooves, and they terminate with an open end in the shoulder of the tyre.

The inclinedly orientated rib profile elements 12, 13; 32, 33; 42, 43; 52, 53; of the above-mentioned embodiments may be such that the width of the rib profile elements b is identical and uniform. However these rib profile elements may have different widths within predetermined limits, such as is apparent from the reference numerals b and b' of Fig. 2. The width of the rib profile elements may be 5% to 10% of the tread surface width B. Ribs of unequal widths are preferably disposed alternately. This does not depart from the characteristic herringbone-like profile of the invention. The tyre profile, which is adapted to the direction of rotation, is suitable both for tyres having a height-to-width ratio of 0.8 and for wide tyres having a height-to-width ratio of up to 0.45. Depending on the envisaged use of the pneumatic vehicle tyres, the ribs are additionally provided with suitable fine incisions.

CLAIMS

1. A pneumatic vehicle tyre, which has a radial carcase construction and a tread surface profile which is adapted to the direction of rotation, the profile comprising a plurality of inclinedly orientated rib profile elements, which extend at an acute angle relative to the centre line x-x of the tyre circumference, and profile grooves which extend substantially parallel thereto and have angular portions in the shoulder region, wherein the rib profile elements and profile grooves of one half of the tread surface extend in the opposite direction to those of the other half of the tread surface, in which the profile groove has its beginning in the region of the centre line of the tyre circumference and is disposed at an angle of inclined orientation relative to this centre line of 15° to 30°, and in which the rib profile elements are interconnected in the region of the centre line of the tyre circumference by means of profile element bridging members, the beginnings of the profile grooves being offset from one another in the circumferential direction.

2. A pneumatic vehicle tyre as claimed in claim 1, in which the angular portion of the profile groove is situated at the boundary between the central region of the tread surface and the shoulder region of the tread surface, and in which the profile groove portion extends in a curved manner at an angle of 95° to 135°, measured relative to the centre of the profile groove, and terminates with an open end in the shoulder of the tyre.

3. A pneumatic vehicle tyre as claimed in claim 1 or 2, in which there is, in the shoulder region of the tyre between the profile groove portions, an additional profile groove which extends parallel thereto and has its beginning

in the boundary region of the angular portion of the groove and terminates with an open end in the shoulder of the tyre.

4. A pneumatic vehicle tyre as claimed in any one of claims 1 to 3, in which the width of the rib profile elements is substantially identical as far as the angular portion.

5. A pneumatic vehicle tyre as claimed in any one of claims 1 to 3, in which the widths of the rib profile elements are not identical and amount to 5% to 10% of the tread surface width.

6. A pneumatic vehicle tyre as claimed in any one of claims 1 to 3 and 5, in which the rib profile elements, of unequal widths, are disposed alternately.

7. A pneumatic vehicle tyre as claimed in any one of claims 1 to 6, in which the profile grooves have a straight, inclinedly sloping groove beginning.

8. A pneumatic vehicle tyre as claimed in any one of claims 1 to 6, in which the profile grooves have a rounded groove beginning.

9. A pneumatic vehicle tyre as claimed in any one of claims 1 to 8, in which the rib profile elements are provided with fine incisions in the circumferential, transverse and/or inclined directions.

10. A pneumatic vehicle tyre, substantially as hereinbefore described with reference to the accompanying drawings.

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